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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|-------------------------|---------------------|------------------|
| 10/020,813 | 12/12/2001 | Srinivasan Chakravarthi | TI-33161 | 8922 |

23494 7590 01/14/2003

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| EXAMINER |
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HUYNH, YENNHU B

| ART UNIT | PAPER NUMBER |
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2813

DATE MAILED: 01/14/2003

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Please find below and/or attached an Office communication concerning this application or proceeding.

| | | |
|------------------------------|-----------------|---------------------|
| Office Action Summary | Application No. | Applicant(s) |
| | 10/020,813 | CHAKRAVARTHI ET AL. |
| | Examiner | Art Unit |
| | Yennhu B Huynh | 2813 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 23 December 2002.

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-7 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-7 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:

1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) Notice of References Cited (PTO-892) 4) Interview Summary (PTO-413) Paper No(s). _____.

2) Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) Notice of Informal Patent Application (PTO-152)

3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.

6) Other: _____

DETAILED ACTION

This is in response to the Amendment filed on 12/23/02.

Election/Restrictions

Applicant's election without traverse of claims 1-7 in Paper No. 4 is acknowledged.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (U.S. 5,773,337) in view of Lee (U.S. 6,037,640)

Re. claim 1:

Lee ('337) disclose:

-forming a coating comprising a dopant over a surface of the semiconductor

substrate 1 (col.2, lines 43-65);

-heating the semiconductor substrate to cause a portion of the dopant to diffuse from the coating into the semiconductor substrate and thereby form a P-N junction within the semiconductor substrate (col.2, lines 5-24 and col. 3, lines 5-31);

-the semiconductor has an interstitial form (col.3, line 12) and at 1000 C degrees, the impurity atom is a faster diffusing species relative to silicon atoms (col.3, lines 32-45);

However, Lee ('337) does not disclose an impurity dosage of 1×10^{13} atoms/cm², and wherein the semiconductor substrate comprises a single crystal.

Lee ('640) disclose:

- the impurity ion has a dose of at least about 1×10^{13} atoms/cm² (col.7, lines 27-30); wherein the impurity atom is fluorine (col.3, lines 7-20).

-the semiconductor substrate comprises a single crystal (col.1, line 67).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Lee ('337) by incorporating an ion dosage of about 1×10^{13} atoms/cm², to avoid short channel effects in forming the ultra shallow junctions.

Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (U.S. 5,773,337) in view of Lee (U.S. 6,037,640) .

Lee ('337) disclose substantially all claimed invention includes:

-Re. claims 3&5: wherein the impurity atom is fluorine (col.1, lines 38-49), and wherein the dopant is boron (col.3, line 2);

-Re. claim 7: wherein the coating comprises a silicate (col. 3, lines 46-60);

However, Lee ('337) does not disclose the impurity ion dosage at about 1×10^{13} atoms/cm² (cl. 2); diffused region is located about 50nm from the surface (cl.4); dopant concentration is at about 1×10^{14} atoms/cm² (cl. 6).

Lee ('640) disclose a ultra shallow semiconductor junction fabricating, which includes:

-Re. claim 2: prior to heating, the impurity ion has a dose of at least about 1×10 atoms/cm² (col.7, lines 27-30);

-Re. claim 4: wherein after heating 90% of that portion of the dopant that has diffused into the semiconductor substrate is located within about 50nm of the surface (col.9&10, lines 60-19);

-Re. claim 6: after heating the concentration of the dopant within the substrate adjacent the surface is at least about 1×10 atoms/cm² (col.9&10, lines 60-5)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the invention of Lee ('337) by incorporating an impurity ion dosage at about 1×10 atoms/cm²; a diffused region is located about 50nm from the surface; dopant concentration is at about 1×10 atoms/cm², to obtain an abrupt change in the slope of the dopant profile at the shallow junctions.

Cited Prior Art

Maszara et al. (U.S. 6,362,063B1) in related art disclose formation of a shallow abrupt junction. The process include a mask, a single crystal substrate having implanting dopant species into the substrate through a coating solid phase epitaxy layer, wherein the dopant located beneath the original amorphous/crystalline interface, formation of such an abrupt junction (col. 3 & 4, lines 5-30. This reference is deemed relevant to the current invention and should be careful reviewed before any amendment is filed.

Response to Arguments

Applicant's arguments filed on 12/23/02 have been fully considered but they are not persuasive.

Applicant' s argument that Lee:

1)-does not disclose the heating the semiconductor substrate to cause a portion of the dopant to diffuse from the coating into the semiconductor substrate.

Lee ('337) disclose the heating the semiconductor substrate at fourth stage to diffuse dopant from the coating into the semiconductor substrate (col. 2, lines 20-25, col. 4, lines 1-13).

2)- does not disclose the coating is a solid source layer.

The limitation "coating is a solid source layer" isn't recited in claim 1.

3)- does not disclose the impurity atom is a faster diffusing species relative to silicon atoms.

Lee does not state that the impurity atom is a faster diffusing species relative to silicon atoms, but Lee disclose that at the subsequent thermal treatment (fourth stage of RTA) the boron diffusion is accelerated (col.1, lines 37-49).

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action.

In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yennhu B. Huynh whose telephone number is 703-308-6110. The examiner can normally be reached on M-F 8.30AM-7.00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

YNBH,

1/7/03


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800